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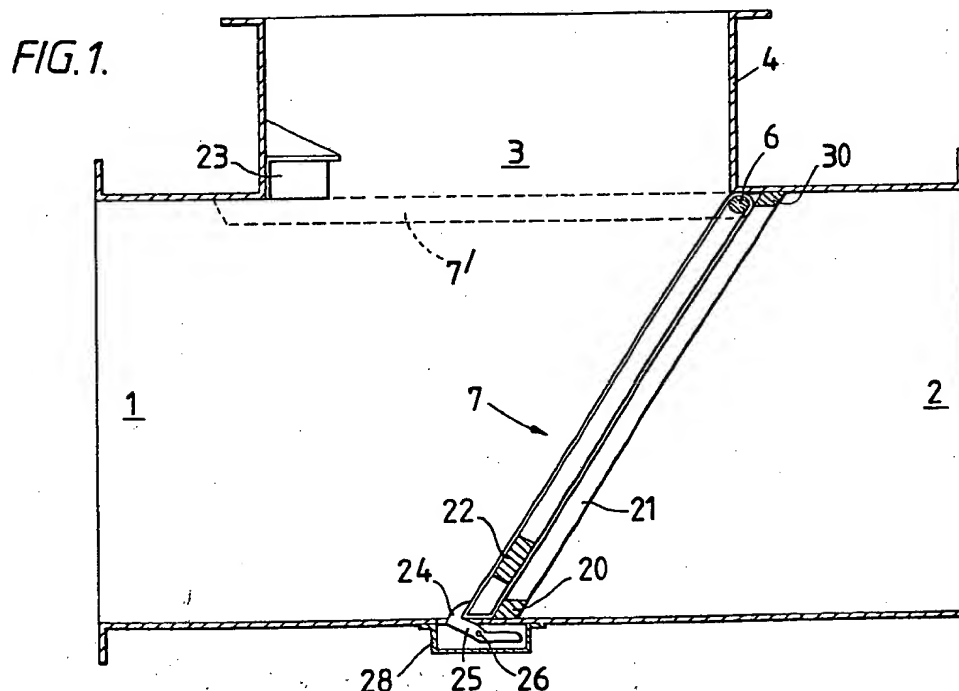
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(54) Smoke diverter valve in air duct

(57) A duct unit for use in air conditioning installations has one inlet (1) and two outlets (2, 3). A flap (7) is swingably mounted for rotation between the two outlets and can be swung from a position in which it closes one of them to a position (7') in which it closes the other and vice versa. Gasketed seatings provide that, in either closure position, there is a proper seal so that the unit may act to prevent the spread of fire. Preferably the unit includes a latch (24-26) adapted to hold the flap tightly sealed in one of its two positions. The valve flap may be spring biased into the latched position and held against the bias by an electromagnet 23. The flap has an external handle for manual resetting.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

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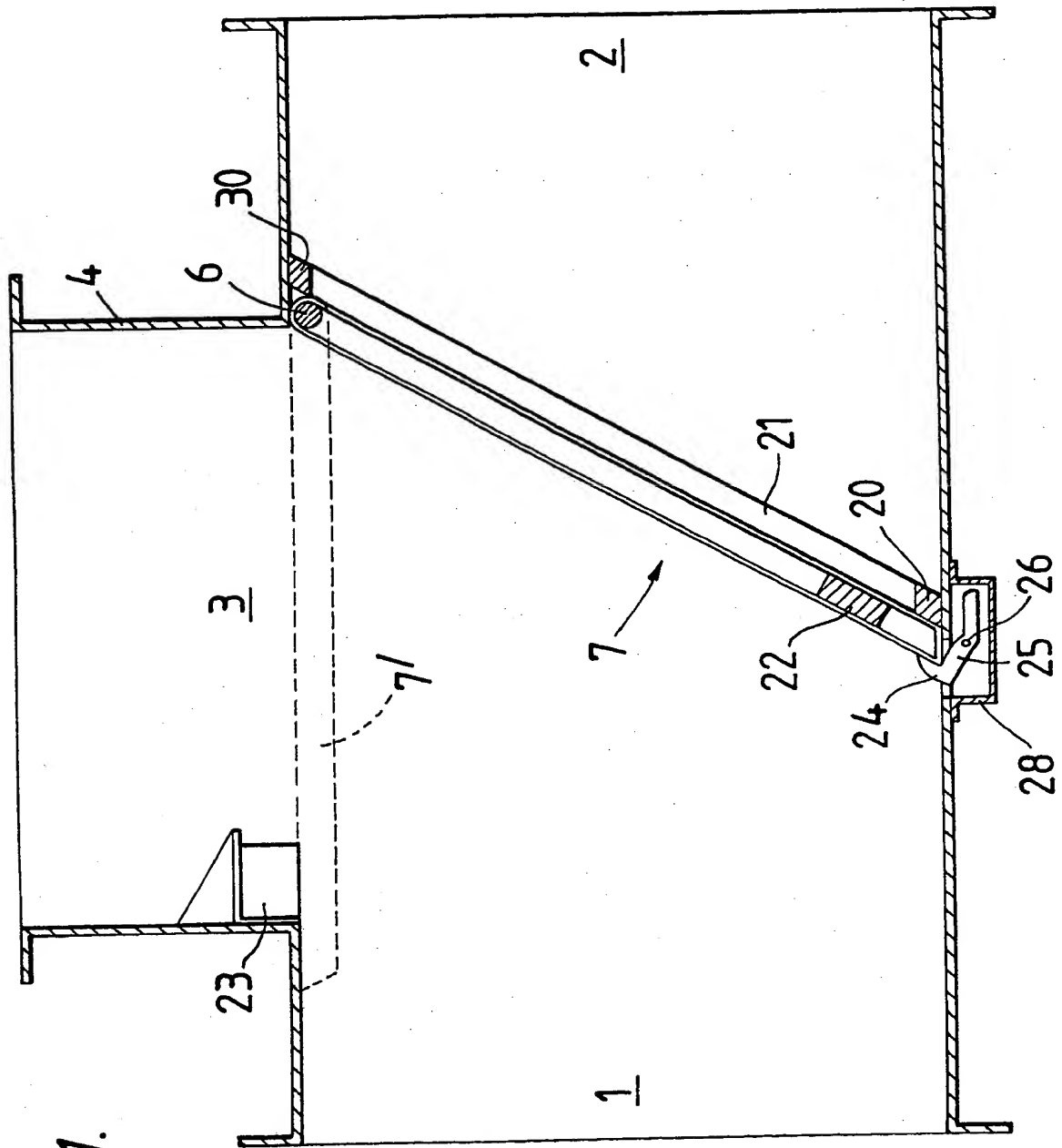


FIG. 1.

FIG. 2.

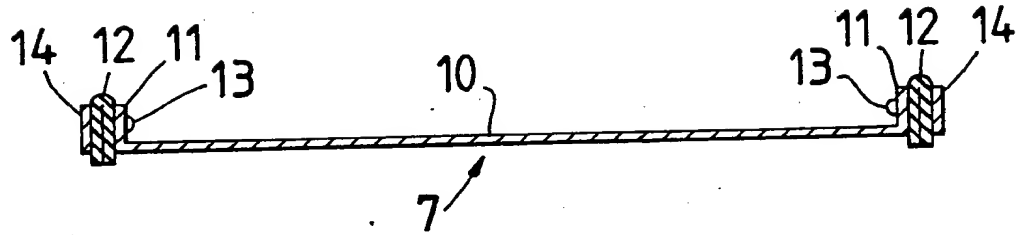
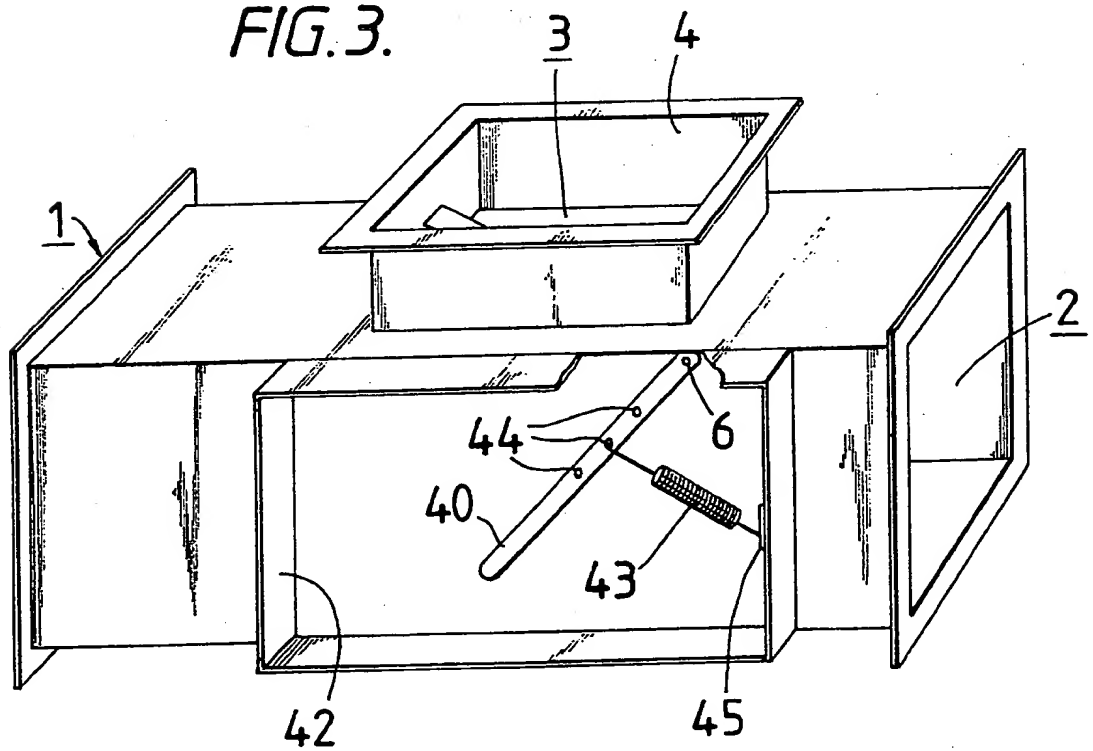


FIG. 3.



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SMOKE DIVERTER UNITS

This invention relates to smoke diverter units, and in particular to units which may be installed as part of the air conditioning ducting within a building.

British Patent Specifications 2103483, 2107982 and
5 2138934 are all concerned with air conditioning systems in buildings. A problem with air conditioning systems in buildings is that they move air from part of the building to another, and if a fire breaks out they can promote the spread of fire and products of combustion from one part of
10 a building to another. In order to design safe systems it is accordingly important to have ways of preventing the spread of fire through air conditioning systems should a fire break out.

The specifications referred to above are related to
15 this problem, and each discloses in broad general terms a mechanism for forming part of a ducting installation including a three way duct piece. This is illustrated diagrammatically in Figures 3 and 4 of specification 2103483 and Figures 5 and 6 of specification 2107982. The
20 duct piece there illustrated has three ports, which in use are arranged as one inlet port and two outlet ports. Within the section is a swingable flap which is arranged to close one or other outlet port. In use, air normally flows through the duct from inlet to the normally open
25 outlet port, e.g. into the next section of a building.

Should a fire break out, the swingable flap is arranged to move to close one outlet port and open the other, e.g. enabling smoke and flames to be diverted, e.g. to atmosphere.

- 5 The specifications as referred to above give no constructional details as to how such apparatus is to be constructed and we have found that a simple hinged flap is inadequate.

- 10 According to the present invention there is provided a duct unit for use in air conditioning and like installations including an elongate duct section defined by sidewalls and having an inlet at one end and a first outlet at its other end, one side wall in the duct section including a second outlet, and a flap swingably mounted
15 for rotation about an axis located between the first and second outlet, and swingable from a position in which it closes the first outlet to a position in which it closes the second outlet and vice versa, wherein around the first outlet and around the walls of the duct are arranged two
20 seatings, each of which can co-operate with the flap, where the edges of the flap are provided with gasketing material adapted to seal the flap against one of the seatings in either position, wherein means are provided to hold the flap normally against the seating around the
25 second outlet to close the same and wherein latch means are provided to hold the flap securely latched against the seating around the walls of the duct when sealing the first outlet.

- 30 Preferably the flap is spring biased towards the seating around the walls of the duct.

Conveniently the flap is hinged by means of a hinge pin set adjacent the same wall of the duct as the second outlet, and preferably the hinge pin is provided with a gasket seal thereagainst.

- 35 Conveniently the cross-section of the duct and of each outlet is rectangular, and the flap is in the form of

a rectangular tray hinged one side and having gasket material at its edges and projecting slightly to both sides of the tray, which gasket material is adapted to abut and seal against the seating about the second outlet or the seating which goes around the walls of the duct.

5 The means for holding the flap normally against the seating surrounding the second outlet is preferably a solenoid. This is arranged in practice to operate in a fail-safe manner i.e. the solenoid is energized normally and holds the flap in the desired position by magnetic attraction. If a fire breaks out or smoke is detected, the electrical supply to the solenoid is interrupted, thus releasing the flap. The flap also releases if there is any other interruption in the supply to the solenoid for
10 any other reason. The device thus "fails safe" diverting air in the duct e.g. to atmosphere should anything happen to the system.

Preferably the wall of the duct opposite the side of the outlet has in it, adjacent part of the seating for the flap extending across the duct, spring latch means which
20 act to latch the flap in position if it is moved to seat against the seating extending across the duct.

Preferably the latch means can be released by an appropriate lever, key or the like from outside the duct. Preferably also the position of the flap can then be moved, again from outside the duct. Most conveniently, the hinge pin of the flap is connected to a lever arm which can be moved manually. The lever arm is conveniently located in a housing located on one wall of
25 the duct, and the flap may be spring biased by an appropriate spring attached to that lever arm and fixed appropriately internally of that housing.

The invention is illustrated by way of example with reference to the accompanying drawings in which
35 Figure 1 is a diagrammatic axial section through a diverter unit in accordance with the present invention,

Figure 2 is a cross-section through the flap member of the unit of Figure 1, and

Figure 3 is a side view of the unit showing the flap actuation lever.

5 Referring to the drawings a duct section has an inlet 1 and outlet 2 and a second outlet 3. The duct is of rectangular cross-section and the second outlet 3 is likewise rectangular. As shown, the second outlet is in the upper horizontal wall or ceiling of the duct though it
10 will be appreciated that it could be in a side wall or in the base of the duct.

Above the second outlet is a similar rectangular section short length of duct with an end flange for connection to a like flange on further ducting if desired.

15 Set on a hinge pin 6 adjacent the ceiling of the duct is a swingable flap 7 of generally tray like construction. This consists, as is best seen in Figure 2, of a steel central tray 10 having upstanding edges 11. Attached round three of its edges is a folded ribbon of
20 ceramic fibre heat insulating tape 12. It is attached to flange 11 by means of rivets 13 which pass through the tape 12 and are secured at their other ends to an external steel strip 14. As clearly evident from Figure 2, the folded ceramic fibre tape 12 is wider than strips 14 or
25 the height of walls 11 and the tape is so arranged that, as shown in Figure 2, the upper edges of the folded ribbon is above the metalwork of the tray and the lower edge is below the metalwork of the tray.

This arrangement enables the tray to seat and seal
30 securely against either of two seatings. The first is formed by the three portions of the ceiling of the duct which surround outlet 3. The second is formed by a seating constituted by three steel bars, one set on the base of the duct and denoted 20 in the drawing and the
35 others set on the sides and denoted 21.

Set at one edge of the tray 7 is a magnetically soft

armature 22. This is designed to cooperate with a solenoid 23 mounted just inside the second outlet 3.

Protruding through the floor of the duct are the jaws 24 of two sprung catches 25 located spaced apart from one another. As shown in Figure 1, the catches are pivoted about an axis 26 and are biased in the clockwise direction by a spring (not shown) to the position shown in Figure 1. A housing 28 surrounds the catch mechanism on the exterior of the floor of the duct.

Hinge pin 6 to which the flap 7 is attached is mounted closely adjacent the ceiling of the duct. A ceramic fibre tape is held compressed against the hinge pin by a bar 30 extending across the ceiling of the duct.

As shown in Figure 3, attached to the end of hinge pin 6 is a lever 40 which is located in a housing 42 mounted on the side of the duct. The cover of the housing is omitted for clarity but a normal sheet steel lockable cover to be provided. Lever 40 is biased in an anti-clockwise direction by means of a tension spring 43 which is fixed between a fixed point 45 such as stud welded to the side of the duct and engages in one of a number of holes 44 located in lever 40. Varying the hole into which spring 43 is fitted varies the spring bias on the flap 7.

When the device is used in the orientation shown in the drawings, relatively light spring bias is needed on spring 43, since the flap will tend to move to the position shown in full in Figure 1 under the effect of gravity. If the item is installed in some other orientation, greater leverage and greater spring bias is secured by engaging spring 43 with a hole 44 more remote from hinge pin 6.

In normal conditions air is passed from inlet 1 throughout outlet 2 with the flap 7 being in the position shown in dotted lines and indicated in 7 in Figure 1. It is held in that position by armature 22 being held by the

electro-magnet 23.

If there is a fire or if for some other reason there is a system problem, the current to the electro-magnet ceases, and the flap 7 drops assisted by the spring bias into the position shown in Figure 1. The configuration of the teeth 24 and the edge of flap 7 cooperate to depress teeth 24 as the flap comes into the position shown in Figure 1, with the spring latches 25 catching over the edge of the flap 7 as the flap impacts on the frame formed of bars 20 and 21.

Prior to such movement, the outlet 3 was sealed by the pressure of one edge of refractory fibre ribbon 12 against the ceiling of the duct. In the position shown in Figure 1, the main outlet 2 of the duct is sealed off by engagement of the other edges of the ribbon 12 against bars 20 and 21.

Ribbon 12 is preferably a highly refractory ceramic ribbon material of the type used for gasketing in high temperature applications. A particularly valuable material is ceramic fibre tape sold under the registered trade mark Fiberfrax by the Carborundum Company Limited. Such materials are available as tapes 2.5 mm thick and 76 mm wide and a folded tape may be used to provide the gasket. Such tapes are resistant up to 1260°C, continuous exposure, so even if very hot combustion products pass along the ductwork, through inlet 1 and out through outlet 3, the integrity of the seal is maintained and hot combustion products do not pass from outlet 2.

CLAIMS

1. A duct unit for use in air conditioning and like installations including an elongate duct section defined
5 by sidewalls and having an inlet at one end and a first outlet at its other end, one side wall in the duct section including a second outlet, and a flap swingably mounted for rotation about an axis located between the first and
10 second outlet, and swingable from a position in which it closes the first outlet to a position in which it closes the second outlet and vice versa, wherein around the first outlet and around the walls of the duct are arranged two seatings, each of which can co-operate with the flap, where the edges of the flap are provided with gasketing
15 material adapted to seal the flap against one of the seatings in either position, wherein means are provided to hold the flap normally against the seating around the second outlet to close the same and wherein latch means are provided to hold the flap securely latched against the
20 seating around the walls of the duct when sealing the first outlet.

2. A duct unit according to Claim 1, wherein the flap is spring biased towards the seating around the walls of
25 the duct.

3. A duct unit according to Claim 1 or 2, wherein the flap is hinged by means of a hinge pin set adjacent the
30 same wall of the duct as the second outlet.

4. A duct unit according to Claim 3, and including a gasket seal against the hinge pin.

5. A duct unit according to Claim 3 or 4, and including
35 a lever arm attached to the hinge pin and located in a housing located on one wall of the duct.

6. A duct unit according to any one of Claims 1 to 5, wherein the cross-section of the duct and of each outlet is rectangular and the flap is in the form of a rectangular tray hinged one side and having gasket material at its edges and projecting slightly to both sides of the tray, which gasket material is adapted to abut and seal against the seating about the second outlet or the seating which goes around the walls of the duct.
7. A duct unit according to any one of Claims 1 to 6, wherein the means for holding the flap normally against the seating surrounding the second outlet is a solenoid.
8. A duct unit according to any one of Claims 1 to 7, wherein the wall of the duct opposite the side of the outlet has in it, adjacent part of the seating for the flap extending across the duct, spring latch means which act to latch the flap in position if it is moved to seat against the seating extending across the duct.
9. A duct unit according to Claim 8, and including means accessible from outside the duct to release the latch.
10. A duct unit substantially as hereinbefore described with reference to the accompanying drawings.

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